Remarks/Arguments

Claims 1-35 are in the application. Claims 1, 8, 10, 11, 20, 22, 23, 26, 27, 29, and 35 are in independent form. Claims 1-7 and 22 are allowed.

Claim objections

Claims 11-13 and 27 are objected to as being dependent on rejected base claims. Claims 1 and 27 are rewritten into independent form.

Claim Rejections – 35 U.S.C. § 103

Claims 8, 14, 20, 26, and 29 stand rejected under 35 U.S.C. § 103 for obviousness over U.S. Pat. No. 6,414,323 to Abe et al. ("Abe") in view of U.S. Pat. No. 6,114,695 to Todokoro et al. ("Todokoro '695").

Abe teaches as system "which can efficiently remove reactant floating in vacuum," that is, a contamination control system for use in a charged particle beam system. The system described in Abe's preferred embodiment is a critical dimension scanning electron microscope ("CD SEM"). Col. 3, lines 45-47. While Abe states that the invention, that is, his contamination control system, can be used with other types of charged particle beam systems, including an Auger analysis apparatus, Abe does not describe an Auger analysis system and does not describe a charged particle beam system that has the required collection efficiency to function as an Auger analysis system.

As described in the specification, because the number of Auger electrons produced is relatively small, the collection efficiency required for Auger analysis is much higher than the collection efficiency required for imaging.

> "[1005] Unfortunately, only a small number of the impacting electrons give rise to Auger electrons. Typically, somewhere between one thousand and one hundred thousand primary electrons are required to produce one Auger electron. To detect a material present in the sample at very low concentrations, it is necessary therefore to efficiently collect and analyze the Auger electrons. Auger electrons are emitted nearly isotropically, that is,

> approximately equally in all directions above the target, so it is necessary to collect Auger electrons from as much of the hemisphere above the sample as possible."

As the Examiner points out, Abe describes a CD SEM that includes a secondary particle detector 7 positioned above the final lens and off axis. The Examiner also points out that while Abe does not explicitly teach a deflector, it is obvious that a deflection occurs because the detector is off axis. Also, while Abe does not disclose an electron energy analyzer, the Examiner states that electron energy analyzers are known and it would be obvious to analyze the electrons.

Abe does not, however, teach a system that deflects and collects secondary electrons with efficiency adequate for Auger analysis. Moreover, Abe does not teach a deflection method that can deflect Auger electrons, which have a relatively high energy compared to other secondary electrons, without significantly degrading the high resolution of the primary beam, which has a relatively low energy in an SEM. Because Abe does not teach solutions to these problems of through-the-lens collection of Auger electrons in a high resolution SEM, a skilled person would not have been motivated to add an electron energy analyzer to Abe's CD SEM system.

Abe does not provide details about how secondary electrons are directed to detector 7, because such detector systems for CD SEMS are know. For example, U.S. Pat. No 5,872,358 to Todokoro et al. (Todokoro '358) shows that a voltage is placed on extraction electrode 24 at the detector entrance to attract secondary electrons away from the primary beam path. Such systems, however, are not adequate for Auger analysis in a high resolution scanning electron microscope, and Todokoro '358 does not, therefore, mention Auger analysis.

Todokoro '695 shows collection of secondary electrons below the final lens (FIG. 17) while high energy reflection electrons are detected above the lens by detector 12. The system of Todokoro '695 uses a primary beam having electron energies greater than 50 keV, so the reflection electrons also have a very high energy. Todokoro '695 mentions Auger analysis, along with photoluminescence, as a tool for component

analysis, together with using a laser beam or an ion beam as an exciting beam, but none of these system are described.

Applicants submit that Abe, neither alone nor in combination with Todokoro '695, teaches a system for Auger analysis in which the Auger electrons are collected through the final lens in a high resolution scanning electron microscope. Moreover, the systems of Abe and Todokoro '695 are imaging systems

Claims 20 and 29 are amended to include an energy analyzer in the body of the claim. Applicants submit that claims 20 and 29 are not obvious over Abe in view of Todokoro '695 for the reasons described above with respect to claim 8, that is, Abe does not describe a system with a collection efficient adequate for analyzing Auger electrons, so there is no motivation to add an Auger electron energy analyzer.

Regarding claim 26, the Examiner states that the prior art teaches a method of performing Auger analysis that includes the steps of claim 26. Applicants submit that the prior art does not teach collecting Auger electrons through the objective lens of a high resolution scanning electron microscope without significantly degrading the resolution. Moreover, the Examiner states that Todokoro '695 teaches forming an image based on secondary electrons. Claim 26, however, recites forming an image of the virtual Auger source and analyzing the electrons. Thus, the image is an electron image formed by converging the electrons, not an image on a CRT formed by assigning a brightness value at each point of the image that is proportional to the number of secondary electrons emitted from that point on the work piece. New claim 33 recites "focusing the Auger electrons near the electron entrance of an energy analyzer."

Claims 9, 10, and 26 stand rejected under 35 U.S.C. § 103(a) for obviousness over Abe in view of Todokoro and further in view of U.S. Pat. No. 5,847,399 to Schmitt et al. ("Schmitt"). Claim 26 was addressed above. Applicants submit that claim 9 and 10 are also patentable for reasons described above with respect to claim 26. Moreover, with regard to claim 10, Schmitt describes a magnetic deflector 60 to deflect the primary beam and a shield 61 to avoid eddy currents that surround the magnetic deflector 60. Abstract. Claim 10 recites "that is conductive on the inside and resistive on the outside." Schmitt

teaches a shield is made "of at least one soft magnetic layer 61a and an electrically insulating layer 61b." Col. 3, lines 35-36.

Claims 15-19 stand rejected under 35 U.S.C. § 103(a) for obviousness over Abe in view of Todokoro '695 and further in view of US Pat. No. 6,310,341 to Todokoro et al. Regarding claim 15-19, the Examiner states that any modifications to the prior art to achieve the claimed invention are considered obvious to the above teachings and not given patentable weight. Applicants submit that these claims are patentable for the reasons described above and further traverses the additional features are obvious. For example, the elements for focusing and directing Auger electrons and adjusting the lower pole piece or sample height to improve Auger transmission or resolution.

Claims 23, 24, 25, 30 and 31 stand rejected under 35 U.S.C. § 103(a) for obviousness over Abe in view of Todokoro '695 and various additional references. Without conceding that the combinations described in these claims are not separately patentable, applicants submit that these clams are patentable for the reasons described above with respect to claims 8 and 26.

Applicants submit that the claims are patentable over the cited art and respectfully request that the rejection be reconsidered and the case be allowed.

Respectfully submitted,

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